



Joint Warfare Analysis

Simulation Validation Cost

Dale K. Pace

The Johns Hopkins University Applied Physics Laboratory

11100 Johns Hopkins Road

Laurel, Maryland 20723-6099

(240) 228-5650; (240) 228-5910 (FAX)

dale.pace@jhuapl.edu

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Economics Of Modeling and Simulation Track

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SCSC99 Validation Cost --
Slide 1



Topics

- ◆ **Introduction**
- ◆ **VV&A Cost Perspective**
 - ◆ **Cost of Inadequate V&V**
 - ◆ **Cost of Verification**
- ◆ **Levels of Simulation Validation**
- ◆ **Validation Cost Elements**
- ◆ **Validation Cost Estimation**
- ◆ **Comments & Challenges**



Introduction

Insights drawn from various sources,

including the SIMVAL 99 Cost Working Group

***SIMVAL 99 Report* at
<http://www.mors.org>**

**Ideas of this presentation *may*
become part of the revised DoD**



VV&A Cost Perspective

There's more than just the cost of doing VV&A

Inadequate V&V can be very costly:

- **\$500M+ each: Ariane 5, 1999
Lockheed satellite**
- **may prevent M&S use or allow
wrong results**

**Software V&V is mainly M&S
Verification**



Levels of Simulation Validation

- **Inspection Level**
- **Review Level**
- **Demonstration Level**



Validation Cost Elements

- **Validation of Simulation Requirements**
- **Articulation of Assessment Criteria**
- **Collect/Organize Authoritative Real World Data for Comparison with Simulation Results**
- **Prepare Review Orientation/Reporting Materials**
- **Id SMEs/Reviewers & Manage Them**
- **Perform Conceptual Validation Reviews**
- **Specify Test Cases for Use in Results Validation**
- **Run Sim Test Cases/Perform Results Validation**
- **Collect/Organize Sim Usage Info/Prior Validation Info**
- **Prepare Synopsis of Validation Info for Accreditation Report**



Validation Cost Estimation - 1

Validation Costs Primarily Related to Sim Size/Complexity

- **Validation of Simulation Requirements**
- **Articulation of Assessment Criteria**
 - ***NOT** Collect/Organize Authoritative Real World Data*
 - ***NOT** Prepare Review Orientation/Reporting Materials*
 - ***NOT** Id SMEs/Reviewers & Manage Them*
- **Perform Conceptual Validation Reviews**
- **Specify Test Cases for Use in Results Validation**
- **Run Sim Test Cases/Perform Results Validation**
- **Collect/Organize Sim Usage Info/Prior Validation Info**



Validation Cost Estimation - 2

Validation Costs Primarily Related to Topic Difficulty

- **Level of Validation Required**
 - **Inspection Level: 10-25% of development cost is common**
 - **Review level: 25-30% of development cost should be expected**
 - **Demonstration Level: >50% development cost is likely**
- **Collect/Organize Authoritative Real World Data**
- **Prepare Review Orientation/Reporting Materials**
- **Id SMEs/Reviewers & Manage Them**



Comments & Challenges

Mature disciplined professionalism can significantly impact validation costs:

“standard” conceptual model descriptions , V&V processes & reports, etc. should minimize validation costs

Simulation advances require improved V&V

➔cultural changes by sim sponsors, developers, & users

- adequate resources in a timely manner

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